Michigan Department of Community Health

MDCH

LabLink

Laboratory Information from the Michigan Department of Community Health - Bureau of Laboratories

Vol. 3 No. 3 April 1998

Salmonella serotype Typhimurium DT 104 in Michigan

Barbara Robinson-Dunn, Ph.D., ABMM
Director, Microbiology Section

In the previous issue of *LabLink* (1997, vol 3, no. 2), background information on the pathogenicity and antibiotic resistance pattern of *S.* ser. Typhimurium Definitive Type 104 was presented. Because of the increasing importance of this bacterium, the Microbiology Section began, screening all isolates of *S.* ser. Typhimurium in October, 1997 for the penta-resistant antibiogram typical of DT104 isolates. This resistance pattern is commonly referred to as R-type ACSSuT and indicates resistance to ampicillin, chloramphenicol, streptomycin, sulfonamide and tetracycline. An additional antimicrobial agent, ciprofloxacin is also tested because of the emergence of resistance to a related fluoroquinolone, enrofloxacin, which has been licensed for veterinary use in the United Kingdom. Another quinolone, sarafloxacin, has been approved for the treatment of *Escherichia coli* infections in poultry in the USA. Resistance to ciprofloxacin has not yet been demonstrated in the United States, however, if it develops, it could have serious public health implications for the treatment of salmonellosis in adult humans.

Antibiograms have been performed on all isolates of *S.* ser. Typhimurium submitted to the Microbiology Section in 1997 and to date in 1998. Antimicrobial susceptibility testing (AST) on all human and non-human *S.* ser. Typhimurium isolates from the first three quarters of 1997 was done under the direction of Dr. Robert Walker, Department of Microbiology, College of Veterinary Medicine, Michigan State University. AST on all later isolates was done in the Microbiology Section, MDCH. In 1997, a total of 277 isolates of *S.* ser. Typhimurium and the O5 negative variant were identified at MDCH. Of these, 82 (29.6%) had the penta-resistant antibiogram typical of DT104. Ciprofloxacin resistance was not detected in any of the isolates.

All of the resistant isolates from the fourth quarter of 1997 have been submitted to the Centers for Disease Control and Prevention for phage typing to determine if they are DT104. Results have been received for 24 of the 28 fourth quarter isolates. Twenty-three of the isolates with the penta-resistant antibiogram have been DT104, DT104a, DT104b or U302 (closely resembles DT104) thus indicating excellent correlation with AST results. One isolate was considered untypeable.

Plans are to perform AST on all *S.* ser. Typhimurium isolates from 1996 as well as those that are received in 1998. Those showing the highly resistant pattern will be forwarded to CDC for phage typing. Ongoing studies at MDCH are attempting to demonstrate differences detectable with the use of molecular typing methodologies so that phage typing may someday be unnecessary.

DCH-0096

E. coli and Shiga-Like toxin

William Schneider, Microbiology Section

The Microbiology Section has been examining *Escherichia coli* cultures for the ability to produce Shiga-like toxins 1 and 2 (SLT1 and SLT2) since January 1, 1997.

All *E. coli* cultures submitted for serotyping are examined, by DNA probe, for the ability to produce SLT1 and/or SLT2. Those strains probe positive for SLT1 or SLT2 are serotyped. We have antisera for O157:H7, O111 and O126 strains. Toxin probe positive cultures that cannot be serotyped with this antisera are sent to Centers for Disease Control for serotyping. We report the SLT results with all *E.coli* strains in addition to the serotyping results. Cultures negative for SLT1 and SLT2 are reported "serotype unknown."

The following chart is the results of SLT testing from the first year (1997) this service has been offered at MDCH laboratories.

Serotype	SLT1 and SLT2 Positive	SLT1 Positive SLT2 Negative	SLT1 Negative SLT2 Positive	Negative for SLT1 and SLT2
O157:H7	95	0	18	0
O157 nonmotile	1	0	4	0
O55:H7	0	0	1	0
O171:H2	0	0	1	0
O26:H11	1	0	0	0
Unknown	0	0	0	376

A total of 497 *E. coli* strains were examined in 1997 of which 121 (24.3%) produced Shiga-like toxin. Three SLT producing *E. coli* strains would have been missed by a serotyping procedure.

Direct Specimen Detection of *Mycobacterium tuberculosis* complex Available at MDCH

Dale Berry, Microbiology Section

The Mycobacteriology Unit began using the *Mycobacterium tuberculosis* Direct (MTD) test by Gen-Probe in February, 1997. The MTD test is an amplified nucleic acid probe system which has FDA approval for detection of *M. tuberculosis* complex from acid-fast smear positive respiratory specimens. These specimens include sputum (induced or expectorated), bronchial lavage, bronchial aspirates or tracheal aspirates. The test is not yet approved by the FDA for use on non-respiratory specimens or specimens which are negative for acid fast bacilli demonstrable by microscopy. Additionally, the MTD test is also limited to specimens from patients who have received less than seven days of antituberculosis therapy or who have not received any antituberculosis therapy in the last twelve months.

In the first year of use at MDCH, 49 smear positive respiratory specimens were tested. When compared to culture, the MTD test had a sensitivity of 100% and a specificity of 100%. In an attempt to validate the test for use on nonrespiratory specimens, additional studies were performed on 11 other specimens. These included tissues (lymph nodes, mediastinal and lung biopsies), stool and abscess fluids. When borderline results were included in the calculations, the test had a sensitivity of 100%, but the specificity dropped to 71%.

At the present time, the MTD test is performed on all acid fast smear positive clinical specimens from patients suspected of having new or reactivated tuberculosis. MDCH is developing a reporting protocol, and will soon begin reporting MTD test results.

Tuberculosis 2000 Videotapes Available

The Francis J. Curry National Tuberculosis Center produced a videoconference entitled "Tuberculosis 2000: Fundamentals of Clinical Tuberculosis and Tuberculosis Control". This three part series is now available for lending through the Microbiology Section. Each tape is two hours in duration.

Part I Diagnosis, Treatment and Screening of Tuberculosis

Part II Prevention of TB, Institutional Control Measures Against TB, And Personal Respiratory Protection.

Part III HIV & TB, Pediatric TB, Public Health Measures Against TB, Health Care Policy & TB Control

Each video can be borrowed by phoning Susan Shiflett at (517) 335-9763.

Enhanced Surveillance Activities for Influenza

Robert Martin, Dr. P.H., Director, Bureau of Laboratories

The outbreak of influenza A (H5N1) in Hong Kong has generated concern among members of the general public, policy makers, and public health officials about the possibility for pandemic spread. On the basis of preliminary investigations in Hong Kong, it appears likely that the virus currently circulating is not efficiently transmitted from person to person, and that poultry exposure is an important risk factor (MMWR 1/9/98). Only one of the 18 confirmed cases was identified through an enhanced system of community-based surveillance. The other cases were hospitalized, many with severe pneumonia. No human case of influenza H5N1 has been identified outside of Hong Kong. Limited enhancement of U.S. surveillance activities of short duration, specifically directed at detecting patients infected with the H5N1 strain is indicated to detect and control influenza disease activity.

Influenza activity typically has two annual peaks in Hong Kong. The first is during March with a larger peak during July. Influenza activity due predominantly to influenza A(H3N2) viruses increased during December and January in Hong Kong. While avian influenza A(H5N1) viruses do not appear to be easily transmitted among humans, increased circulation of human influenza strains during the next few months could increase the potential for gene reassortment between a human influenza A virus and an avian influenza A(H5N1) virus. This situation could result in a virus with the avian H5 hemagglutinin which would have the propensity for spread much like a typical human influenza strain.

The recommendations below focus on detecting importations of influenza A(H5N1) or a genetically related virus from Asia. These recommendations will enhance our ability to detect new strains and to provide information that will be useful in addressing the spread and control of disease (e.g., determining the adequacy of vaccine components).

Recommendations

In addition to the existing surveillance for influenza, based upon CDC recommendations, MDCH will:

1. Institute hospital-based surveillance, and
2. Enhance laboratory surveillance.

Hospitalized patients **who traveled to Asia within 10 days from onset to symptoms** and have unexplained pneumonia or acute respiratory distress symptom (ARDS), a fever of >100` F, and are between 1 and 60 years of age should be tested for influenza virus infection by viral culture of nasopharyngeal and throat swabs. Hospitals that do not have access to viral culture may submit respiratory specimens to the MDCH laboratory.

The MDCH test request form **must** indicate recent travel to Asia and the symptoms compatible with influenza. All influenza viruses detected (at MDCH or hospital/independent laboratories) must be typed and subtyped. Those not identified as H3N2, or H1N1, or B should be referred immediately for testing for influenza A(H5N1). Laboratories that have suspect influenza A isolates from these patients should submit the isolate to the MDCH laboratory for complete subtyping. Rapid antigen tests for influenza A should **not** replace viral culture in these patients since the rapid antigen test has a low sensitivity and culture will be required to type H5N1 viruses.

In Michigan, we are asking for participation in enhanced surveillance activities by requesting vigilance and reporting by health care providers. We are notifying travel clinic health care providers, hospital infection control practitioners, and local health departments of the need to expand surveillance. In addition, we are instituting enhanced surveillance among the influenza sentinel physicians network. The MDCH Laboratory has the reagents to provide complete typing and subtyping of influenza viruses.

If no resurgence of influenza A(H5N1) activity occurs in Hong Kong and no spread of influenza A (H5N1) viruses is detected outside Hong Kong, expanded surveillance for H5N1 viruses will be discontinued at the end of September 1998.

These activities will be important for the early detection of influenza A(H5N1) and for implementation of appropriate control measures.

The following individuals can be contacted to respond to questions:

William Hall, MD, Acting Director, Bureau of Epidemiology, (517) 335-8165

Mary Grace Stobierski, DVM, Communicable Disease Epidemiologist, (517) 335-8165

Frances Pouch Downes, DrPH, Director, Infectious Diseases Division, Bureau of Laboratories, (517) 335-8067

Louis Guskey, PhD, Director, Virology Section, Infectious Diseases Division, (517) 335-8099

Influenza Season 1997-98 Update

Cal Frappier,Virology Section

Since the November 1997 issue of the *LabLink*, Michigan and other WHO Collaborating laboratories in the US have tested over 51,000 specimens for the Influenza virus. Of these 7,500 (15%) were positive for Influenza viruses. Of that, 99.9% were type A, with 99.7% subtyped as A/H3N2. Michigan has reported one of only five A/H1N1 subtypes, and one of only ten Type B viruses.

Other statistics from Michigan:
Respiratory specimens received----------231
Positives, total (incl Parainfluenza, HSV, Entero,etc.)----76
Positive Influenza detection (A or B) ----------40
Positive Influenza culture ---------- -28
Subtyped as A/H1N1----------1
Subtyped as A/H3N2 ----------27

The newly formatted CDC Influenza Sentinel physician program in Michigan has contributed 25% of the positives.

It is recommendded the 1998-99 Influenza vaccine include an A/Sydney/5/97(H3N2)-like virus, an A/Beijing/262/95 (H1N1)-like virus, and a B/Beijing/184/93-like virus.

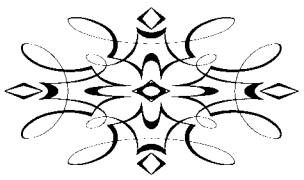
Antimicrobial Resistance Guidlines now Available

The Michigan Society for Infection Control (MSIC), in collaboration with the Michigan Department of Community Health, has published the booklet: "Guidelines for Prevention and Control of Antibiotic Resistant Organisms". These booklets were distributed free of charge to infection control practitioners in local health departments, private hospitals, and long term care facilities.

Copies of the guidelines are now available directly from MSIC for purchase by interested parties. To obtain a copy, send a check or money order in the amount of $15.00 to:

Sue Burns
MSIC Marketing Chairperson
Henry Ford Hospital
Infection Control
2799 West Grand Blvd. CFP-6
Detroit, Michigan 48202

Please make checks payable to MSIC.



Reporting GenProbe PACE 2 Results

Frances Pouch Downes, Dr. P.H.,
Director, Division of Infectious Diseases

The GenProbe PACE 2 System for diagnosis of *Chlamydia trachomatis* and *Neisseria gonorrhoeae* are widely-utilized non-culture assays for diagnosis of genital infections. These assays actually offer greater sensitivity than mailed or transported cultures, when on-site culture is not available.

Michigan Public Health Code (PA 368 1978) and associated Administrative Rules require laboratory directors to report to public health agencies laboratory evidence of *C. trachomatis* and *N. gonorrhoeae* infection. Laboratory reporting is a critical link to disease control by assuring adequate therapies and prevention counseling and facilitating partner notification by public health programs.

Some clinical laboratories in Michigan are reporting GenProbe PACE 2 results as "High Negative" and "Low Positive." This practice deviates from result interpretation included in the Food and Drug Administration (FDA)-approved product insert. Clinical Laboratory Improvement Amendments of 1988 require laboratories deviating from the FDA-approved testing and reporting guidelines validate the alternate use of the testing product. MDCH and public health laboratories in other states are investigating the clinical relevance of "grey zone" results. These studies are not yet concluded and it is premature to make any interpretations of "grey zone" results other than those outlined in the product insert. The practice of "grey zone" result reporting is not consistent with the FDA-approved usage of the product. Laboratories need to follow the result interpretive guidelines in the product insert. These are:

POSITIVE- The difference between the response in Relative Light Units (RLU) of the patient specimen and the mean of the Negative Reference replicates is greater than or equal to 350.

NEGATIVE- The difference between the response in RLU of the patient specimen and the mean of the Negative Reference replicates is less than 350 RLU.

Centers for Disease Control and Prevention recommends confirmation of non-culture assays results for diagnosis of *C. trachomatis* and *N. gonorrhoeae* infection (MMWR 42[RR-12]). A study by Beebe et al. of specimens submitted to public health laboratories, reported that PACE 2 confirmation (PCA) was indicated in specimens yielding a net reading of less than 2000 RLU. If PCA is not available in your laboratory, we encourage you consider implementation of the confirmatory test. If GenProbe PCA is not a viable option for your laboratory, we encourage you to identify a reference laboratory which offers this test (a list of public health laboratories performing PCA is attached). If neither of these options is possible, at a minimum we encourage you to supply the submitter with information on the specificity of unconfirmed positive results in your laboratory.

Quirky bugs . . .

Sandip Shah, MS, MT(ASCP)
Microbiology Section

CASE HISTORY

The patient is a 58-year-old white male who was admitted a large hospital in southeast Michigan in September, 1997 for a stroke. His past medical history was significant for therapy for endocarditis, mitral valve prolapse, cirrhosis, hepatitis C, and pancreatitis. He also had a long history of ethanol abuse. Subsequent to the stroke he was unable to communicate, but some history was obtained from family members indicating recent extended travel (eight months) in the Dominican Republic.

During his hospitalization he developed sepsis and blood cultures were obtained. An aerobic coryneforme-like gram positive bacillus was grown from the blood cultures. The patient did not exhibit any symptoms of pharyngeal, tracheal or other respiratory involvement. Apparently during his stay in the Dominican Republic, he had received some medical and dental treatment for unknown reasons.

When the submitting hospital laboratory's culture suggested *Corynebacterium diphtheriae*, the patient's physicians contacted CDC and obtained diphtheriae antitoxin: the patient was treated with 100,000 units and was given antimicrobial prophylaxis with penicillin and vancomycin. Subsequent cultures were negative. The public health investigation included culturing 3 family contacts. The contacts were negative as were PCR tests done at CDC.

The submitting laboratory provided results of biochemical testing to the Reference Bacteriology Unit. Testing at MDCH confirmed the identification of this isolate as *C. diphtheriae* biotype *gravis.* It was subsequently sent to CDC for toxin analysis and was found to be a non-toxigenic strain.

DISCUSSION

Diphtheria is a disease that has almost completely disappeared from developed countries. It was first described by Bretonneau in 1821, with the causative organism, *C. diphtheriae*, subsequently being isolated by Loëffler in 1883. The first case of a *C. diphtheriae* bacteremia was reported in 1893. Since World War II, the number of cases of diphtheria has dramatically declined in developed countries because of availability of adequate vaccine. Until 1987, systemic infections involving this organism were rare. Only 10 cases of diphtheria were reported in France between 1984 and 1986, and two cases were reported in 1987. However, in 1990, an epidemic occurred in Russia and revealed that diphtheria has again emerged in Eastern Europe, especially in Russia and Ukraine. This provided the impetus to determine the incidence of *C. diphtheriae* infections in France. Between 1987 and 1993, a total of 59 *C. diphtheriae* strains were isolated in France. Epidemiological data has shown that 40 strains were isolated from normally sterile sites including 34 from blood cultures and half of the bacteremic patients developed endocarditis. Osteoarticular involvement was noted in 11 of these 40 patients, including five bacteremic patients. The fatality rate following bacteremia was 36%, despite specific antibiotic treatment with beta-lactam class antibiotics and aminoglycosides. The mean age of patients who participated in this study was 38 years. Half of the patients lived in lower socioeconomic conditions and suffered from homelessness or alcoholism. Studies have shown that the skin was the major route of transmission in this reemerging disease. Most Paris area isolates were *C. diphtheriae* subtype *mitis* while others from elsewhere (overseas) belonged to subtype *gravis*. The fact that none of these strains were positive for the *tox* gene by PCR, makes this study especially significant.

C. diphtheriae infection causes localized inflammatory lesions of the upper respiratory tract or skin, with associated necrosis at distant sites (myocarditis and neuritis) attributable to the dissemination of diphtheria exotoxin. In rare cases, the organism can cause endocarditis, septic arthritis and splenic abscess. Of the 55 reported cases of *C. diphtheriae* endocarditis, 25 have been in children. Since the advent of antibiotics, only two of these have been due to toxigenic strains.

Non-toxigenic strains continue to circulate throughout the world, including countries where diphtheria is epidemic. Besides France, where the most increases in non-toxigenic but systemic disease have been observed, a few cases have been reported in Switzerland, Australia, the United Kingdom, Singapore and now in the United States. Only 58 cases of bacteremic infections due to toxigenic or non-toxigenic *C. diphtheriae* strains were described between 1893 and 1995.

Laboratories should maintain their capability to isolate and identify this historic bacterium. Microbiologists are encouraged to contact the Microbiology Section (517) 335-8134 with questions about potential isolates of *C. diphtheriae.*

References:

1. Patey, O., et al. 1997. Clinical and Molecular Study of C*orynebacterium diphtheriae* Systemic Infections in France. J. Clin. Microbiol. 35:441-5.

2. Pennie, R.A., A.S. Malik, L. Wilcox. 1996. Misidentification of Toxigenic *Corynebacterium diphtheriae* as a *Corynebacterium* species with Low Virulence in a Child with Endocarditis. J. Clin. Microbiol. 34:1275-6.

Introduction of a Portable Instrument for Analysis of Blood Lead in Children

Jeff Dupler, Chemistry and Toxicology Division, Lead Section

Despite dramatic declines in the prevalence of childhood lead poisoning, an estimated 4.4% of American children have elevated blood lead (BPb) levels. The National Health and Nutrition Examination Survey (NHANES III) suggest that one million children between the ages of 1 and 6 years have BPb $\geq$ 10 ug/dl. Because a significant number of children are lead poisoned in the first year of life and NHANES III does not evaluate this age group, the data underestimate the scope of the problem in the first 5 years of life.

In September of 1997 the Food and Drug Administration announced the clearance of a portable device that can quickly detect high lead levels in blood. The LEADCARE In Office Test System was developed by ESA, Inc. of Chelmsford, Mass. and AndCare, Inc. of Durham, N.C. Partial funding was provided by the U.S. CDC whose effort has been to stimulate a blood lead test that can be performed at point of care or in the physician's office laboratory (POL).

The instrument is a hand-size device which works by anodic stripping voltammetry. In this process whole blood undergoes chemical lysis of erythrocytes. Lead atoms in the blood are then electrochemically plated onto a gold-colloid sensor. An electrical potential strips the lead from the gold, yielding a voltammogram whose peak corresponds to lead concentration. A liquid crystalline display screen reports BPb after an analysis time of approximately 3 minutes. The cost of the analyzer kit is $1,800.00 and each test sensor is $6.00 (a venous sample prepared in duplicate would cost $12.00). Clinical studies conducted by the company indicate that the test is as reliable as established laboratory test methods for detecting lead poisoning.

Under the Clinical laboratory Improvement Amendments of 1988 (CLIA 88) the instrument testing has been classified as moderately complex. All clinical laboratories, regardless of location, size , or type of laboratory must meet standards based on the complexity of the tests which they perform. Laboratories performing moderate and/or high complexity testing must meet requirements for proficiency testing, patient test management, quality control, quality assurance, and personnel. The major difference in regulatory requirements between moderate and high (conventional GFAAS) complexity testing are in the quality control and personnel standards. Of note is a recent survey of clinical laboratories using proficiency testing data to compare quality of results. Significant differences exist among POLs, POLs using licensed clinical laboratory scientists (medical technologists), and non-POLs. Traditional testing sites achieved higher rates of satisfactory performance than newly regulated, alternative testing sites. Testing personnel in many POLs might lack the necessary education, training, and oversight common to larger facilities. Laboratory directors at all testing sites must ensure that they understand laboratory practice sufficiently to minimize errors and maximize reliability.

The LEADCARE system has big potential for overseas use and by health professionals in areas which may lack the refrigeration and other equipment needed to conduct more conventional tests. For interested POLs The Regional Offices of the Health Care Financing Administration and Regional Laboratory Directors should be contacted for implementing the final rules of CLIA 88.

Questions for the MDCH Lead Lab are welcome by telephone: (517)335-8244; or FAX: (517)335-9773.

Trends in Perinatal HIV Transmission in Michigan

Garry Goza, M.S.,
HIV/AIDS Surveillance Section

The State of Michigan HIV/AIDS Surveillance Section, in conjunction with the Centers for Disease Control and Prevention (CDC), has collected data on the number of children exposed to HIV, the number of children with a confirmed diagnosis of HIV/AIDS, and the number of children that seroreverted (lost maternal antibody) since 1992. In 1995, MDCH received supplemental funding from the CDC to collect more comprehensive data on perinatally exposed children, including information on maternal and neonatal Zidovudine (ZDV) use. This information will aid the State of Michigan in evaluating the implementation and impact of the United States Public Health Service (USPHS) perinatal prevention recommendations and prepare Michigan to respond to the requirements of the reauthorized Ryan White CARE Act of May 1996 (RWCA).

Surveillance data indicate that maternal use of ZDV has increase from 13% in 1992 to 93% in 1996. Similarly, neonatal ZDV use has increased from 6% in 1992 to 90% in 1996.

With the increase in of maternal and neonatal ZDV use, the number of children infected with HIV/AIDS in Michigan has decreased between 1992 and 1996. For the birth year 1992, there were 7 (11%) children confirmed to be HIV infected within a year of birth, compared to two (5%) children for birth year 1996. The number of children diagnosed with AIDS within a year of birth has also decreased from a total of two (3%) children with AIDS for birth year 1992 to zero children for birth year 1996.

These surveillance data demonstrate that Michigan has made significant progress in implementing the USPHS Guidelines. An increased number of HIV-infected pregnant women are being given ZDV prophylaxis and fewer of their children are becoming HIV infected. This indicates that Michigan is well on its way to achieving a 50% reduction in perinatal transmission of HIV over 1993 levels as required by the RWCA. As the USPHS Guidelines become integrated into women's prenatal care, these trends are expected to continue.

If you would like further information or a copy of the complete report, please contact the HIV/AIDS Surveillance Section in Lansing at 517-335-8165, or in Detroit at 313-876-0353.

Updated recommendations on treatment and prophylaxis for HIV infected pregnant women are available. They may be found in the January 30, 1998 Report and Recommendations issue of the *MMWR* entitled "Public Health Service Task Force Recommendations for the Use of Antiretroviral Drugs in Pregnant Women Infected with HIV-1 for Maternal Health and for Reducing Perinatal HIV-1 Transmission in the United States" (Volume 47, No. RR-2)

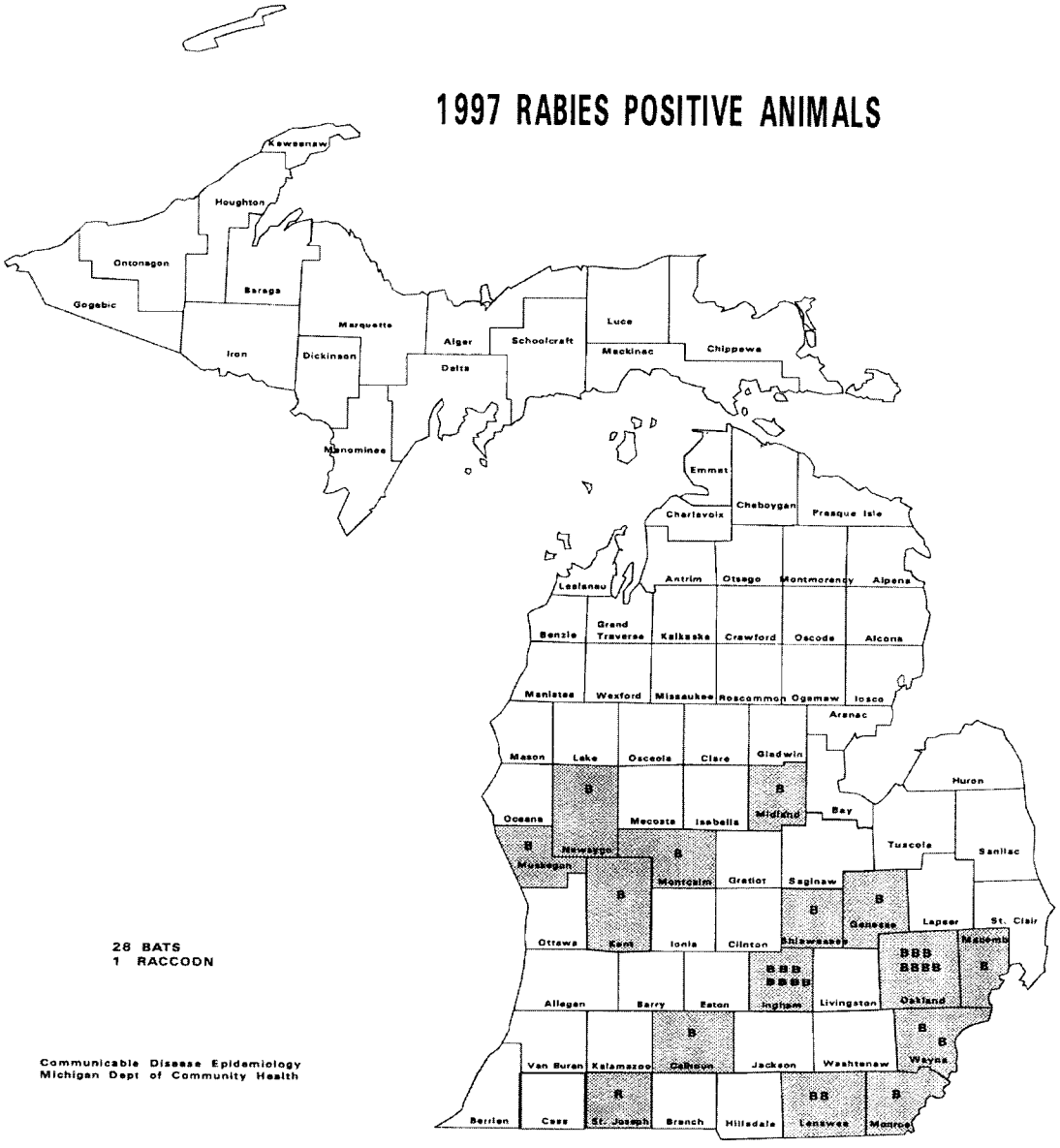
Rabies Specimen Submission

Beginning January 1, 1998 - United Parcel Service will not accept rabies samples for shipment.

To avoid shipment problems - strictly adhere to the "Directions for the Collection and Submission of Animal Heads for Rabies Examination" (FD-47 Revised 12/97) provided in the collection units beginning December 19, 1997. A copy of the revised directions are available upon request, for your review.

Properly packaged specimens, in the one gallon container, may be shipped by Courier, Express Mail or Federal Express. **The 3.5 gallon containers may not be mailed, but may be shipped by Federal Express as long as specimens are properly packed with adsorbent material and enclosed in a corrugated box as indicated in the directions provided.**

Any components, such as "over seal" clips, orange shipping labels or adsorbent material not included in your current supply of rabies units (Unit 47) may be obtained by faxing your order to (517) 335- 9039, or by phoning your request to (517) 335-9867.



Antimicrobial Resistance Trends, Regions One (Reg 1, Detroit Area) and Two to Twelve (Reg 2-12, Outstate Michigan) Penicillin Resistant Study-site[1] Isolates of *Streptococcus pneumoniae* and Vancomycin Resistant Sterile-site[2] Isolates of *Enterococcus spp.*
Michigan Sentinel Hospital Laboratory Survey, Fourth Quarter, 1995 through Third Quarter, 1997

Percent Resistant[3]

Microorganism	Resistance Classification[3]	1995 Quarters Mean[4] Third & Fourth		1996 Quarters Mean[4] First to Fourth		1997 Quarters First		Second		Third	
		Rg 1	Rg 2-12	Rg 1	Rg 2-12	Rg 1	Rg 2-12	Rg 1	Rg 2-12	Rg 1	Rg 2-12
Str. pneumoniae	Moderate or High	20	14	25	18	28	16	26	19	25	31
Str. pneumoniae	High Level only	5	4	7	3	10	5	17	6	9	6
E. faecalis	Resistant	1	0	2	1	3	1	2	0	2	2
E. faecium	Resistant	34	7	41	9	42	6	59	12	45	3
Total *Enterococcus*	Resistant	8	1	10	2	15	2	15	4	10	7

[1] Study sites = blood, CSF, deep surgical wound, pleural fluid(fl.), peritoneal fl., respiratory specimens or synovial fl.

[2] Sterile sites = blood, CSF, deep surgical wound, pleural fluid(fl.), peritoneal fl., or synovial fl.

[3] NCCLS, Performance Standards for Antimicrobial Susceptibility Testing, M100 - S7.

[4] Weighted quarterly mean was calculated for years 1995 and 96.

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Director, Bureau of Laboratories
Robert Martin, MPH, Dr. P.H.

Editor
Susan L. Shiflett

Editorial Review
Frances Pouch Downes, Dr. P.H.

Design and Layout
Susan L. Shiflett

Michigan Department of Community Health
Bureau of Laboratories
P.O. Box 30035
Lansing, Michigan 48909-7535